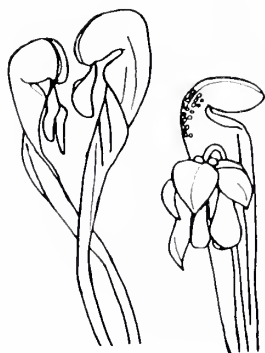


CARNIVOROUS PLANT NEWSLETTER

VOLUME 11, Number 4

DECEMBER 1982





CARNIVOROUS PLANT NEWSLETTER

Official Journal of the
International Carnivorous
Plant Society



Volume 11, Number 4
December, 1982

COVER

Nepenthes villosa in habitat on Mt. Kinabalu. Photo by Dave Taylor. See article, page 89.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Mrs. Pat Hansen, 3321 Hamell Rd., Fullerton, CA 92635. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ARBORETUM.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff. Copy deadline for the March issue is Feb. 1, 1983.

CO-EDITORS:

D. E. Schnell, Rt. 1, Box 145C, Pulaski, VA 24301

J. A. Mazrimas, 329 Helen Way, Livermore, CA 94550

T. L. Mellichamp, Dept. of Biology, UNCC, Charlotte, NC 28223

Leo Song, Dept. of Biology, California State University, Fullerton, CA 92634

Seed Bank: Patrick Dwyer, St. Michael's Episcopal Church, 49 Killeen Park, Albany, NY 12205, USA.

BUSINESS MANAGER: Mrs. Pat Hansen, c/o The Fullerton Arboretum

PUBLISHER: The International Carnivorous Plant Society by the Fullerton Arboretum, California State University, Fullerton, CA 92634. Published quarterly with one volume annually. Printer: Kandid Litho, 129 Agostino Rd., San Gabriel, CA 91776. Circulation: 734 (150 new, 584 renewal). Dues: \$10.00 annually, \$15.00 foreign. Reprints available by volume only. ©1982 Carnivorous Plant Newsletter. All rights reserved.

THE I.C.P.S. BY-LAWS— LET'S GET GOING!

by Don Schnell

CPN kind of started out as an orphan. Many people, especially those with great experience with various botanical and plant societies and their bulletins, newsletters and journals, commented on how CPN grew into such a fine publication and never was associated with an organization. So, after many suggestions that we do indeed organize, we finally put the cart in front of the horse and put the International Carnivorous Plant Society together more than a year ago.

Every society has some kind of by-laws, and we have ours. For some time, they have been undergoing various stages of approval and fine tuning by the Arboretum and legal counsel and they are ready at last. You will recall that about a year ago, we tried to activate the society by holding an election for officers as required by the interim by-law rules, but nobody came! Apparently, the rules of nomination and election were not understood by the readers as they were presented in abstracted form in CPN, or else no one was quite sure they wanted to get involved with leadership.

We co-editors have been taking care of CPN for years, and the interim by-law

rules provide that we *temporarily* lead ICPS also until officers are installed. We should not, nor do we wish to, continue as interim officers of the society forever. We must hold elections, install officers, and begin the many fine activities which the by-laws indicate the society should be doing in addition to continuing CPN.

There is a copy of the ICPS by-laws included in this mailing, and you should read them through. Legalese has been minimized and we believe they are understandable. Note the provisions for officers, for amending the by-laws in case you, as a member, have some ideas that would benefit all, and the proposed activities of the society.

We would certainly like to hear your comments on all of this and on any points in the by-laws. But remember that the by-laws can only be changed through an amendment process, which is not all that difficult and provides for broad input from other society members. Above all, we must elect officers, appoint committees, and get going!

SEED BANK*

(Oct. 25, 1982)

Byblis gigantea (10), *Darlingtonia californica* (5), *Dionaea muscipula*, *Drosera aliciae* (15), *D. anglica* (5), *D. auriculata* (5), *D. binata multifida* (2), *D. brevifolia* (2), *D. burkeana* (1), *D. burmannii*, *D. capensis*, *D. capensis* (narrow leaf), *D. capillaris* (5), *D. capillaris* (long leaf), *D. curvispica* (1), *D. dielsiana* (15), *D. erythrorhiza* (1), *D. filiformis* (3), *D. filiformis filiformis* (10), *D. hilaris* (1), *D. indica* (5), *D. intermedia*, *D. linearis* (10), *D. montana* (6), *D. natalensis* (2), *D. nitidula* (2), *D. peltata* (4), *D. pulchella* (2), *D. pugmaea* (15), *D. rotundifolia*, *D. spatulata*, *D. spath.* (Kansai), *D. spath.* (Formosa) (5), *D. spath.* (white fl.), *D. trinervia* (4), *Nepenthes gracilis*, *N. khasiana*, *N. mirabilis*, *N. rafflesiana*, *Pinguicula alpina*, *P. caerulea* (5), *P. caudata* (1), *P. corsica*, *P. grandiflora* (10), *P. grandiflora* f. *phallida*, *P. grandiflora rosea*, *P. lutea* (10), *P. primuliflora* (2), *P. vulgaris*, *P. vulgaris* bicolor, *Sarracenia flava*, *S. leucophylla*, *S. minor* (5), *S. purpurea purpurea*, *S. purpurea venosa* (15), *S. rubra* (2), *S. psitt.* × *minor*, *S. purp.* × *psitt.* (1), *Utricularia capensis* (5), *U. gibba* ssp. *gibba* (1), *U. lateriflora*? (6), *U. subulata* (5).

*For instructions on how to send or order seed, see CPN March 1982, page 4.

News and Views

BILL CARROLL (Chatham Botanical, P.O. Box 691, Carrboro, NC 27510) sent the following in on how he constructed CP plant beds outdoors in his area.

The plant beds are about 0.6 x 2.4 m. (2 x 8 ft.) and 15 cm (6 in.) deep in the ground. A wood frame around and above the bed keeps surface water from running in, and keeps out debris and weed seed. See figure 1.

Fairly heavy plastic (4 mil) is used to line the beds. Do not nail it to the frame until the soil mix has been watered in and allowed to settle for a few days or else the weight of settling will tear the plastic around the nails. He uses a soil

mix of two parts brown fibrous peat (Canadian type) and one part vermiculite. Avoid using perlite because it floats and will cover any small plants.

At the lowest corner of the bed, the plastic is stretched under the frame. Excess water easily drains away. A short type of sphagnum moss (live) was plugged in randomly with most going to the lower end. This held the "soil" in during heavy rains. See figure 2.

A weak solution of water soluble fertilizer was applied once a month during the summer. Within three months the moss plugs had grown to completely cover the bed. A year later, an area of 30 x 60 cm (1 x 2 ft) yielded about four liters (one gallon) of extra moss every two months during the summer.

Although the beds were originally built for producing *Dionaea* plants and seed, one bed was planted with *Sarracenia rubra* rescued from a construction site. Many flowered this year and seed pods are now ripening! (See photos, right.)

SPECIAL NOTICE:

Now that CPN has gone to bulk mailing for U.S. subscribers, it is more important than ever to advise us of address changes. Bulk mail is *not* automatically forwarded to the new address. Most of it comes back to us, postage due (or 37¢ for each magazine). If one issue comes back to us, we mail no further issues until we receive notification of a new address. So—if you have moved and have not received your CPN, that may be why.

S. alabamensis alabamensis. The photo shows two types of pitchers: tall erect summer pitchers and recurved spring pitchers. These are robust pitchers from a wild population. Please note the cm scale on the left side of the photo. Cultivated traps usually do not approach this degree of robustness. The populations other people have seen have been shaded and consequently photos of wild plants from shaded populations will not give the full character of the species. The photo was taken in late fall (when the largest traps are produced); plants were growing in full sun in hillside seepage bog. Sent by Tom Gibson, Dept. of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721.



NB: cm scale



Figure 1. Plant beds are 2 ft. \times 8 ft. and 6 in. deep. Wooden frame keeps out surface water, debris and weed seed.



Figure 2. Plastic stretched under frame at lowest corner causes excess water to drain away. Sphagnum moss plugs help retain soil during heavy rains.

DAVID HARBSTER (3804 S. Walapai Dr., Apt. 01, Flagstaff, AZ 86001) writes: One of my Venus' Fly Trap leaves "fell" into one of its own traps. The petiole apparently tripped the trigger hairs and the trap closed. Three days later the trap opened. There was not a sign of any harm to the trap nor petiole "prey."

RICKY MAUDER (112 Harbour View, Titirangi, New Zealand AK7) writes: I have read that CP growers in England have problems with *D. auriculata* and other tuber-forming sundews. Perhaps if they make the compost poorly draining like clay, then they might have more success. They should not let the pot dry out to bone dryness but water them periodically.

The *Drosera auriculata* here generally likes to be in a fairly sunny position although I have seen them in a fairly deep shade in secondary growth bush. They form clumps with several individual plants scattered around an area. The soil varies with clay (poorly-draining) being the most common place to find them with some mosses, grasses and rushes. They seem to grow best when a little humus is present and the soil is a little better drained. The plants grow with thicker stems and can often reach 2 ft. in height. Growth starts in May in the southern hemisphere when a rosette will form on the soil surface, or it will commence in late July and will shoot directly from under the ground when the rosetted ones begin shooting upwards. By late August, the faster growing plants will start flowering and the season continues until November, when the plants die down. Seed germinates the following winter and grows a small rosette and then a small stem. Only a small number of insects are caught by the leaves and I observed that better looking plants must obtain some nutrients from the soil that is richer. When the plants have completely died down, the ground dries, but it is periodically moistened by rain. To prevent your tubers from drying up, it might be a good idea to give them a little water every now and then.

There are two kinds of *Drosera binata* growing in Northland (N.Z.). They are *D. binata dichotoma* "small" and "large." The large type is found in swamps and at the back of salt marshes amongst tall rushes and reeds. There the leaves may reach up to 1m (3 ft.) high and span about 9 inches wide. Most of them are about 2 ft. high. Nearly all have germinated on fallen logs and roots grow down into permanently wet ground. A few were growing directly in the soil but were in an airy position. Growth starts here late in July but doesn't really get away until September. They flower in Jan.-Feb. and die down immediately. The seed is released around March. The "small" type is found in sphagnum bogs and on seeping rocks and clay banks. The leaves commonly have 14 prongs on them. The ones growing on clay banks are rose-red in color and very healthy looking, suggesting that they get some sort of nutrients from the soil. They grow the same as the larger form. In places (esp. sphagnum bogs), they grow so thick it is impossible to walk without squashing heaps of them. It's a red carpet of glistening leaves. The seed germinates during autumn and grows slowly in winter and then increases its growth rate in spring. The seed seems to germinate erratically.

JOE MAZIRMAS reports that the August San Francisco Flower Show was again a success. The exhibitors were Raymond Triplitt, Louise Avila, Joe Mazrimas, Larry Logoteta, Emmi Weiss, Thomas Koerber, Glenn Greenawalt, Harold Charns and Gene Dong. The best of show was won by Ray Triplitt for *Nepenthes truncata*. The show is open to anyone who lives in the greater Bay Area. In order to enter the show, you must send a postcard to the manager of the CP section in June 1983. He will send you the entry form and book as soon as they are ready. Please send your postcard with your address to: Tony Rea, 296 Precita Ave., San Francisco, CA 94110. Incidentally, the first five exhibitors mentioned above were winners in at least one category. (See photos page 91.)

DON SCHNELL comments on why seed to two rare CP plants are not readily available in the seed bank. It has to do with the availability of viable pollen to fertilize the flowers. He says: The only time I ever got pollen from *Heliamphora* was when I was growing them under lights and the flowers opened against the warm, dry cover glass immediately beneath the tubes. I was then able to produce seeds, seedlings, and hence the article in the NYBG publication. Since they have been in the greenhouse, the anthers always stay soft, even in older flowers when the stigma is long, brown, and dry, then when the anthers do dry, they still do not dehisce. I think open air and sunlight without greenhouse ceilings intervening are required for proper maturation. In the lights/terrarium setup, this was simulated since the cover glass never fits tightly and there is less humidity near the top, and the flowers were right up next to the warm glass. *Drosera regia* might also require drier air and brighter light to dehisce pollen.

PAUL SIMONS, 8 Gunter Grove, London SW10 0UJ, England writes: The British Carnivorous Plant Society has produced a fascinating booklet entitled "Meat Eating Plants" for their stunning exhibit at this year's Chelsea Flower Show. The booklet outlines the variety of carnivorous plant traps, but is mostly devoted to an intriguing description of carnivory in less well known species—including Shepherd's purse seeds and petunias—as well as the possibilities of carnivory in a whole host of other plants. This 12 page, fully illustrated (12 illustrations) publication can be ordered, price £1.00 including postage, from:

The Secretary, Carnivorous Plant Society, 40 St. Thomas Road, Brentwood, Essex, England.

While in southeast Texas recently working on computers, RICH SIVERTSEN used his spare time to do some CP scouting

in the Big Thicket area. He found a man transplanted from the Bronx who had a superb growth of *Sarracenia alata* in his pasture. Of course, he had the familiar complaint that the browsable grasses and forbs were decreasing while the *S. alata* was flourishing. He plans to bulldoze the pasture and reseed it to grass this winter and has given an open offer to anyone interested in CP to come and collect all the *S. alata* they want. Contact by mail ahead of time (or phone—get number from information): Mr. Joe Dianni, Rt. 2 Box 622, Warren TX 77664. He will give directions to his place. It is felt that a six-pack would be an appropriate gratuity.

STEVE SMITH (Rt. 1, Box 296, Kirkwood, NY 13795) has found what may be the answer to the algae problem in growing *Aldrovanda*. He had previously used the tea made by soaking Canadian peat in hot water, but this and many other methods result eventually in an overgrowth of algae and severe decline in the *Aldrovanda*. He is now trying a solution of ½ teaspoonful of tannic acid in ½ gallon of water. If algae starts to grow from the original inoculum, he adds ½ teaspoonful of tannic acid additional once a week until the algae turns yellow and dies. Meanwhile, so far, his *Aldrovanda* culture is considerably rejuvenated with budding and new growth. Steve will keep us posted on how this new method works over the long run.

New locations for *Sarracenia purpurea* ssp. *purpurea* f. *heterophylla* continue to be discovered by intrepid CP explorers. STEVE SMITH (1159 Trim St., Kirkwood, NY 13795) has discovered previously unreported locations in upstate New York, these being in the proximity of Binghamton, NY. Two bogs were located with the plants and Steve offered proof with excellent photos of the veined and heterophylla forms growing side by side and even intermingled in the open sphagnum bog. The area is supposedly riddled with bogs yet to be explored.

1982 Activities of the North Carolina Carnivorous Plant Growers

Ron Gagliardo
1216 Cooper Drive
Raleigh, North Carolina 27607

It all began last January on a chilly 30° F. day. The first congregation of NCCPG was held in Raleigh. The topic was "Northern CP" as presented by Don Schnell. Members present were 8.

This meeting got the ball rolling and the next one came in early April when we camped out near the Green Swamp. This meeting started out Saturday morning with a tour of the swamp and later a plant rescue led by Stanley Rehder. At the rescue site, members indulged in acres of *Sarracenia flava*, *rubra*, *purpurea*; *Drosera capillaris* and *intermedia*. We returned to camp that night for a "gourmet" dinner prepared by chefs Floyd Rich (Reidsville, N.C.) and Jim Powell (Chesapeake, VA). Polish sausage, vegetables and ravioli were on the menu! The remainder of the evening was spent in general conversation about CP. Members present were 12.

Our May meeting was a treat for all. Don Schnell and family had us all out to their place for lunch. We were all so impressed with Don's collection, but we couldn't figure out just how he could grow mature and flowering specimens of *Heliamphora* and *Darlingtonia* in the hot 100 °F greenhouse. It was truly a CP lover's delight with rare CP like *Drosophyllum*, *Heliamphora* and unusual *Utricularia* on display. But we soon discovered that Don wasn't the only plant nut in the family. Mrs. Schnell displayed a complete collection of Begonias and Peperomias! We can't thank the Schnell family enough for all their time, food, and fun. There were 18 members present.

Moving into July, we caught up with Steve Smith (Kirkwood, N.Y.) who was on vacation. A small group met with him before the Green Swamp trip and sat in total awe during his slide presentation on *Nepenthes* and other unusual CP. The next day we proudly wore our CP shirts which

read "Carnivorous Plant Growers" on the front and a detailed *Nepenthes* on the back, thanks to Jim Powell. We then were ready to visit the Swamp to see *S. purpurea*, *minor*, *rubra*, *flava* hybrids; *Drosera capillaris*, *intermedia*, *brevifolia*; *Utricularia purpurea* in bloom! Another interesting meeting ended with 6 members present.

Our next meeting will be in early September. It will include a plant contest so new members are encouraged to start pruning and shaping up their plants. Prizes will be awarded. Our future plans might include a trip to Australia!

Because we have members from other states now, the name of our organization has been changed to the "Eastern CP Growers." Membership is \$1.00/yr. and requests to join should be sent to the author.

CP GROUP MEETS IN SOUTHERN CALIFORNIA

The first meeting of a carnivorous plant interest group for Southern California took place on Saturday, September 23 in Irvine, California. The meeting had been in the planning stages for over a year. Through mail, flyers, and an announcement in one issue of *CPN*, I finally contacted about 15 persons in the Southern California area.

Basically, the purpose of the meeting was to gather persons in the area who were interested in CP, regardless of experience, to exchange ideas, expertise, and perhaps even plants. About eight persons attended the meeting.

Wayne Mrazek spoke briefly on his recent trip to Mt. Kinabalu in Malaysia. He passed around a few photos he took on his trip to *Nepenthes*, etc.

It was more or less the feeling of those at the meeting that formation of a struc-

Once In a Lifetime

by David W. Taylor

The flight along the coastline was enjoyable, and it was interesting to be able to see the landscape and the miles of jungle below. Suddenly in the far distance, I saw the outline of a mountain shrouded in mist. Could that be Kinabalu? We very soon reached the small airport of Kota Kinabalu, and yet another bus drove us to yet another hotel.

After we had settled in our modern hotel, I decided to look around the town. It was market day, and there were people everywhere. The town itself was not impressive; in fact, its description as a concrete jungle was very apt.

The diesel-driven bus that was to take us on the long journey to the Kinabalu National Park arrived on time the following morning, and we were soon outside

the vicinity of Kota Kinabalu and out into the countryside. The drive was very bumpy on roads that were full of holes and after six hours of torture and continuous replacement of cases that were piled up on the back seat, the bus eventually ground up the narrow roadway to the small arrival post of the Kinabalu Park. The large, comfortable chalets that were afforded us were brand new, and we were the first people to use them. They were situated on the left side of a narrow winding track known as the Kamborangah Road which is the beginning of the summit trail to the peaks of Mount Kinabalu. It was early evening and there was not much to do apart from explore some of the surrounding forest tracks,

(Continued next page.)

NEW CP SOURCE

Carnivorous Gardens
P.O. Box 224
Stones Corner 4120
Brisbane, Queensland
A U S T R A L I A
75¢ for catalogue
Seed of native and N.A. CP

CP Group in So. Cal.

tured club or official chapter of the I.C.P.S. was undesirable at this time. For the time being, at least, things will be left on an informal basis. We are tentatively planning the second meeting for approximately three months from now. Also in the works is a plan to participate in the Los Angeles Fern Society's annual exotic plant show as a group. I plan to compile a roster of attendees listing species of CP grown to facilitate trading and information exchange.

Anyone interested in participating in our next meeting should contact me at my new address: Steve Clancy, 2009-D S. Circle View Drive, Irvine, California 92715. (714) 553-8408 or (714) 833-7309.

OOPS!

Many members noticed and commented on the black captions for the front and back covers of the September issue. Those who examined the pages carefully could see that the captions originally printed were blacked out; in fact, they are the captions for this issue, which were inadvertently mixed up en route to the printer. Fortunately, an alert employee of Kandid Litho realized the error and was able to black out the incorrect captions. The only real confusion came on page 64 of the September issue, which referred to the back cover photo of *Nepenthes bicalcarata*. *Nepenthes bicalcarata* appears on the back cover of *this* issue.

The September covers are photos of paintings by Mr. Paul Connor. Mr. Connor is an accomplished wildlife artist whose paintings have been used regularly by the National Wildlife Federation for their annual conservation stamp series, the US Postal Service for commemorative stamps of natural subjects, Audubon Magazine, and several other publications. He has generously donated the use of these paintings to CPN.

after which it was early to bed in order to be ready for our first full day in the park.

The Kinabalu National Park was established in 1964 and measures some three hundred square miles. I had come here with the specific interest of finding and photographing *Nepenthes*. In the short time that we all had here, I knew that it would be impossible to see every species of *Nepenthes* that the park contained, so I decided to inquire as to the best places to explore to achieve maximum sightings. I was told that the summit trail would be my best track to take, as I would see at least three species and some good scenery besides. This suited me, and I decided to spend my first full day walking up the summit trail. Nobody seemed to want to tackle the gradual climb towards the thirteen-and-a-half-thousand-foot peak of the mountain on the first day, so I had to go alone. Dressed in shorts and tee shirt with a jungle hat, and camera with flash-gun attached slung over my shoulder, I set out on my climb up the mountain early on the morning of August 4th, 1981. The summit trail really started from a power station at the end of the Kambarangah Road, and I soon found myself walking through a maze of twisted trees and steep banks covered in various ferns and mosses. I stopped for a few minutes to gaze at a beautiful waterfall that was cascading crystal clear water down a slippery bank and under the soaked wooden foot bridge where I stood. Further on, the track became tricky, as there were some larger trees to pass by, whose roots were sticking out of the ground wherever one looked. The soil here was of a sandstone clay mixture, and I was thankful that I had a good thick tread on my walking boots. Even so, it would still be easy to catch a foot in the gnarled and twisted root system of the trees, and end up spraining an ankle. I must be careful, I kept thinking to myself, as I trod on a very stout piece of root and hoisted my body over the top of it and down again back

onto the track. Suddenly, I found myself in a small clearing and I was able to look out over the vast area of the national park below. A wisp of cloud drifted over the top of me, and I realized that I was making good headway up the mountain. I was watching all the time for *Nepenthes* plants, and it was not long after my short stop to view the breathtaking scenery of the park, that I saw my first plant. It was on the right hand side of the track, twisting its way round the lower branches of a small tree, competing with a large healthy looking fern that was also growing at the foot of the tree. The species was *Nepenthes tentaculata* and as I walked further up the track, I saw many more plants. It was strange to notice that they were all growing on the right of the track, but they were certainly very abundant. The attractive crimson and green pitchers were everywhere, and there were also seedling plants growing out of the mossy ground as well. According to my guide book, and the map of the mountain region, I was on an elevation of 6,500 feet. The Kambarangah Road where our chalets were was at an elevation of 5,000 feet, so I had climbed a fair distance in quite a short time. After a session of photographing *Nepenthes tentaculata* I trudged on in search for my next species. I really wanted to see *Nepenthes lowii*, and I knew that I was getting very near to the level at which it grew, but I could not see any. Feeling a bit disappointed, I looked up the track, which was now getting very steep. I was determined to get as far up as I could and my next aim was the moss forest. Here was a beautiful part of the mountain where moss grew everywhere, covering the ground, and hanging from the trees. Once here, I found myself alone in a wonderland. There were mosses, ferns, and many orchids, all growing in harmony together, and there was complete silence. I had to keep walking, as the only other species of *Nepenthes* to be found was *N. villosa*. I suddenly walked out onto a larger clearing which was misty with cloud. There



Nepenthes tentaculata
(Mt. Kinabalu)

Photo by D. Taylor.



Nepenthes lowii
(Mt. Kinabalu)

Photo by D. Taylor.



Nepenthes truncata,
grown by Ray Triplitt, won Best of Show
at San Francisco Garden Show, Aug. '82.



San Francisco Garden Show
August, 1982.

Photos by J. Mazrimas.

was quite a breeze blowing, and it was noticeably colder. This was the site of Carsons Camp, and the old tin shack standing here was a reminder of the early explorers of Mount Kinabalu. I was now at a level of 8,000 feet, and I was feeling tired and hungry. I now had to climb over rocks, apart from keeping my footing on the slippery track. But it was worth it, because just fifteen minutes after leaving Carsons Camp, I sighted *Nepenthes villosa*. I could hardly have missed it. The enormous, fat, bizarre-looking pitchers just drew one's eyes, and I stood for a while looking at them in disbelief. The temperature here was only 58 degrees Fahrenheit, and it was windy. Some plants had been broken by the wind, and decaying pitchers lay on the ground. The plants themselves were big, with stems over one-half-inch thick. Their leaves were anything up to 18 inches long, and were very conspicuous among the surrounding vegetation. The pitchers were so remarkable, that I couldn't keep my eyes off them, and it was a tremendous experience to see and photograph such a wonder of the botanical world.

My hunger was getting the better of me by now, and I sat on a rock surrounded by *Nepenthes villosa*, and began to eat my lunch. After this, I decided to press on, although I knew that could not go on much further as I must allow time to return to camp. I eventually made the decision to turn back at 9,500 feet, although I was sorry to have to stop my climb upwards.

As I wandered back down the mountain track, I stopped at the place where I first spotted *Nepenthes villosa*, and I picked up two pitchers that were broken off from the main plants. I felt that I just had to take them back to show the rest of the party. My weary legs were aching from the climb, but now at least it was a little easier for me on the descent. I was still as enchanted with the moss forest as I was when I first entered it on the way up, and eventually I found myself looking once again at the *Ne-*

penthes tentaculata plants, so I knew that I was well on the way towards the start of the summit trail.

As my feet trod onto the stoney surface of the Kambarangah Road, I looked up to the peaks of Kinabalu that rose high above, misty and majestic. I took my time in getting back to the chalets, but was pleased when they came into sight. It was early evening as I climbed the steps to my chalet amid welcoming calls from my colleagues. I was glad to get my muddy boots off, and rest awhile on the bed before discussing my day's adventures. The two *Nepenthes* pitchers I had brought back with me caused a lot of excitement, and everybody wanted to photograph them. I did see a huge pitcher of *Nepenthes lowii* the very next day, when a colleague had better luck than I in finding a solitary plant. I was sorry to learn that there had been much illegal collection of this species on the mountain slope, and consequently it was difficult to find the very few plants that were left.

The following few days at Kinabalu were spent in exploring the forest tracks and botanizing. I longed to spend more time at this fascinating place, but we had to move on. The last remaining days were to be spent seeing some of the tourist attractions. These included a visit to Poring Hot Springs, a tropical beauty spot where one can see *Rafflesia*, the world's largest flower. Unfortunately we were just several weeks too late in seeing the spectacular sight, but we did see some of the largest bamboo trees in existence.

We delighted in the beauty and serenity of the botanical gardens at Singapore, as well as the exquisite blooms of colorful orchids in a private garden. The wide and varied colours of the many flowers in this garden gave me an excuse to test my photographic skills, which I did with much commitment.

My three weeks of adventure was now over, and I was preparing myself for the long flight home, a return journey from an adventure that comes just once in a lifetime.

TISSUE CULTURE OF *PINGUICULA*

by Bill Carroll, P.O. Box 691
Carrboro, N.C. 27610

Butterworts (*Pinguicula* sp.) are usually propagated by seed, leaves or occasional sideshoots. Tissue culture is a relatively new method. With proper equipment and sterile laboratory techniques almost any plant can be tissue cultured.

The most difficult aspect of tissue culture is the elimination of bacterial and fungal contaminants. For most species of *Pinguicula* I have worked with*, it is necessary to take out the shoot meristem. This is the very center of the plant, where the new leaves emerge. When all other leaves and roots are cut away there is much less chance of contamination.

As a first step to obtaining clean tissue, the shoot is washed with soap and water. Next the shoot is trimmed again so that only unopened leaves remain at the tip. By now the shoot is less than one centimeter in height. It is placed in a solution of .5% sodium hypochlorite (10% chlorine **P. lutea*, *pumila*, *caerulea*, *ionantha*, *planifolia*, *primuliflora*, *gypsicola*, *lilicina*).

bleach such as Chlorox). Adding a drop of liquid soap per twenty milliliters of solution helps the chemical sterilize the plant tissue. After shaking for fifteen to twenty minutes, the tip is removed in a sterile environment and rinsed twice in sterile water.

A sharply pointed scalpel and forceps are used to cut out the center of the shoot tip, one to two millimeters in size. This is the meristem, a white or colorless group of cells usually shaped like a somewhat rounded, microscopic pyramid. Placed on the right combination of nutrients and plant hormones,* protected from contaminating organisms, and supplied with optimum light and temperature, the tissue will thrive.

When the tissue grows to about 1 centimeter in height, it can be divided and placed on other nutrient media having different amounts of hormones or other chemicals. Sometimes a lot of tissue is

* See Table 1.

Table 1. MEDIA INGREDIENTS FOR *PINGUICULA*

		milligrams/liter
CaNO ₃	Calcium Nitrate	1000
NH ₄ NO ₃	Ammonium Nitrate	300
KH ₂ PO ₄	Potassium Phosphate	250
MgSO ₄	Magnesium Sulfate	250
MnSO ₄	Manganese Sulfate	10
Fe Chelate	Iron Chelate	20
Thiamine		10
Inositol		100
Sucrose		20,000
Agar		12,000

Plant hormones for shoot multiplication are Kinetin or 2iP in a range of 0.5 to 2.0 mg/liter of solution. Auxins for rooting were IBA or NAA in a range of 0.1 to 1.0 mg/liter.

The media is brought to a boil while stirring constantly, dispensed into test tubes or other containers, and steam sterilized for fifteen minutes at fifteen pounds of pressure (120° C. or 250° F.).



Pinguicula pumila
Grown from seed.

Photo by Bill Carroll.



Pinguicula pumila
Grown from tissue culture.

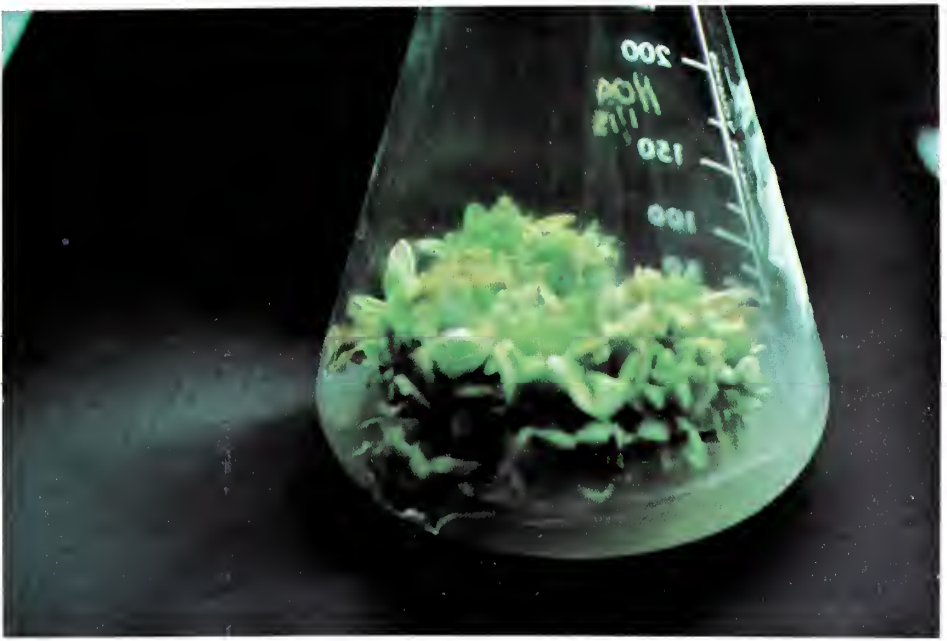
Photo by Susan Sizemore.

Compare seed vs. clone



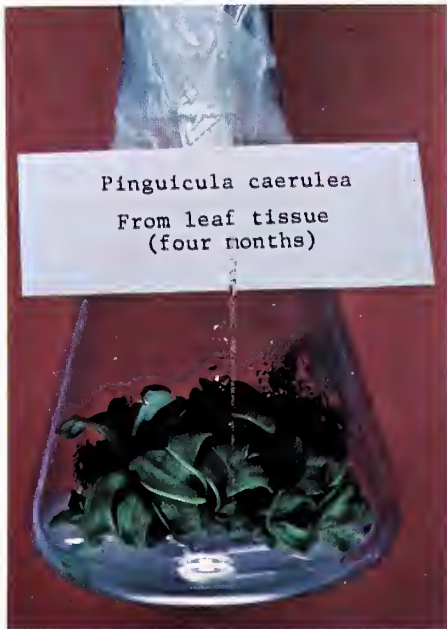
Cloned *Pinguicula lutea* and cloned *Dionaea muscipula* in the greenhouse. Cloned plants appear normal.

Photo by Bill Carroll.



Shoot multiplication of *Pinguicula lutea* *in vitro*.

Photo by Bill Carroll.



Pinguicula caerulea
From leaf tissue.



Pinguicula ionantha.
Comparison of two media.

Photos by Susan Sizemore.

needed to find the right combination for shoot multiplication. Once this is discovered, there is no end to the number of plants that can be produced. Later, some plants are moved to nutrient media with root-inducing hormones at different concentrations. In about a month, the plants can be transferred to soil.

Tissue cultured plants are transferred to soil much like tender seedlings. The nutrient media is first washed off to prevent disease organisms from starting. Roots are gently covered and the plants watered in with a ¼ strength solution of liquid fertilizer. The container is covered with clear or opaque plastic or glass to reduce light and hold in humidity. This cover is removed a little more each day over seven to ten days. The plants gradually adjust to their new environment.

Laboratories worldwide now produce tissue cultured ferns, orchids, African violets, as well as many other tropical plants. Some rare plants are becoming plentiful. Countries that restrict imports of soil grown plants can now receive plants *in vitro* in sterile conditions, making more varieties available to everyone.

FURTHER READING

From Single Cells To Plants, E. Thomas and M. R. Davey, Wykeham Publications, London, England, 1975.

Introduction To In Vitro Propagation, D. Wetherell, Avery Publishing Group, Inc., Wayne, NJ 07470, 1981.

Plant Propagation, the Future is Here, C. Haramaki and C. Heuser, American Horticulturist, August/September, 1980.

Plant Tissue Culture Methods, National Research Council, Ottawa, Canada K1A 0R6, 1982 (NRCC 19876).

Propagation of Higher Plants Through Tissue Culture: A Bridge Between Research and Application, Symposium Proceedings, National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161, 1978 (CONF-7804111).

Propagation of Higher Plants Through Tissue Culture: Emerging Technologies and Strategies, Journal of Environmental and Experimental Botany, Vol. 21, Number 3/4, 1981.

(Submitted August, 1982.)

WHY THEY DO OR DO NOT GROW

by Don Schnell

How many times have those of us who grow CP noted one or both of the following events?

An article appears in CPN or some other publication going into great explicit detail about how a particular CP species can be grown—indeed, the author may insist that it *must* be grown the way he outlines or your plants will surely expire. You smile smugly and comment that you have been growing the same species a completely different way and the plants are perfectly healthy, or you come across one or more additional articles, these perhaps describing completely different ways of growing healthy specimens.

The second event is that you read a superbly detailed article about how to

grow a CP to exquisite perfection. Everything seems to be there in print—water, pots, soil, fertilizer or no, light, etc.—Everything. So you set out, follow the direction to the letter, and your plants promptly go under.

This has happened to all of us, and woe be to the poor author beleaguered with smug or angry letters, respectively.

Are the authors right? Are they wrong? Well, they may be neither, or both. It comes down to a matter of perspective. There seem to be few absolutes among life forms, and many relative factors affecting them. And after that five cents worth of philosophy, let's see what might have gone wrong—or right.

In the first instance, where the plant does not seem to be as fastidious and

fussy as implied, this is probably true. If we look to the way things look in the field (that always helps), how about those *Sarracenia purpurea* ssp. *purpurea* that thrive—as expected in nice, cool acid sphagnum bogs in the north country—but also in alkaline, open sunny and often hot marl-sandy fens in the same region? This is just one example. It illustrates that seemingly delicate species may indeed have more latitude than we expect.

Remember, growing plants out of habitat in pots in greenhouses or under lights or two thousand miles away from where they naturally occur is a stress. Even the finest appearing plants in cultivation are under stresses not present in native habitat. So the plant may well react atypically. Also, CP are generally held to be poor competitors ecologically. Once a native habitat is changed in such a way that the soil or hydration becomes more conducive to competitive plants that were previously held at bay, the poor CP's are often overwhelmed.

The grower in the first instance mentioned above, then, may have undefined stresses in his particular area that preclude his CP being grown in any other but his way in his locale. But as we saw above in the *S. purpurea* example, a species may actually be quite diversified in its requirements once a basic few have been met, perhaps plenty of water that is generally non-toxic, and little competition. So, if you are going to describe how you grow CP, be wary of the use of *always* and *must*, and remember you are describing a growing system that works for you where you are, under your conditions.

Now how about the detailed failure in the second example at the beginning of this article? Actually, pretty much the same principles we have been discussing apply. In the second instance however, the grower describing his technique may well have overlooked one or more factors important in his growing system in spite of the detail of his report. Is he careless? Not at all. There may be some

undefinable variabilities in his growing system that perhaps no one could notice causally, that might perhaps require detailed research and study. Maybe he has too much boron in his water he uses. Who might know this right off, or what difference it would make in combination with all the other variables?

So, when you read a very nicely detailed article on how a grower manages his CP species, remember it is *him* in *that locale*, *under those circumstances*. There are many things we take for granted or cannot easily know (at the other extreme) that would not appear in a list of our observations.

Well then, is it indeed hopeless writing and reading all these articles on how to grow CP? Absolutely not! Quite the opposite. The only hope is to continue our horticultural endeavors and pass on our observations to our fellows. Horticulture is itself a science and contributes far more to our knowledge of plants than some of our botanist brethren might care to admit. It has been said you do not really know a plant until you have grown it—or tried to. So the botanist who rarely sees the inside of a greenhouse or holds a pot in hand, is really missing the boat. Each stressed growing attempt is itself an experiment if we try to define and control conditions to the best of our ability.

The important lessons, then, seem to be that if you write an article on how you grow CP, remember that your conditions are relative, and open your mind and text to other factors or variables. If you read an article on how to grow a CP species, remember that the author may well be describing all growing factors in seeming detail, but there may be so much more he cannot have easily noticed. For instance, even in a heated or air conditioned greenhouse controlled to the same temperature and humidity, the daylight photoperiod is going to be a lot longer in Ontario on June 21st than it is in Florida. Did anyone think to consult the almanac, or any one of a hundred other things? (Continued page 102.)



Chelsea Flower Show

Photos by J. Sirkett



The Chelsea Flower Show

by John Sirkett, British CP Society

This year, for the fourth time, the Carnivorous Plant Society staged an exhibit at Chelsea Flower Show. I have just read an article that described it as "one of the most daring we have ever attempted," which is an interesting comment, and one that I would not question. During the judging, we were described as a young and vigorous society (some of us didn't feel all that vigorous by the end of the week), and it was suggested, very politely, that we were showing plants that were not really any of our business, but in many ways, that's what we were trying to find out.

What do *you* mean when you say Carnivorous?

Perhaps I had better start at the beginning and explain. Chelsea is one of the world's great flower shows. The Royal Horticultural Society put up a big white tent in the middle of London, and for a week in May, it is filled with the most spectacular things that the world of horticulture has to offer. The exhibitors get about two weeks in which to put up their stands, though most use rather less time. Everything must be ready for 4:00 p.m. on Monday, when the Royal party arrives to view the show. On Tuesday, it is open from 8:00 a.m. until 8:00 p.m. for members of the Royal Horticultural Society to view, and then for the next three days it is open to members of the public. Last year, a quarter of a million people came to see it. For the Society, it is our main event of the year, where we go out and meet the public, and try to correct some of the mistaken ideas about carnivorous plants that people seem to have. We are, after all, an educational charity. I will admit, however, that there is another reason for exhibiting. We sell an introductory booklet about carnivorous plants, and try to make a lot of money! This is essential to keep the Society going. Our costs for such things as the meetings, journals and newsletters are currently much higher than our income from subscriptions.

For the last three years, we have tried to put on a spectacular display of c.p., and we have been awarded two silver gilt and silver medal for our efforts. The first two years' displays were based on replica bogs; however, last year a commercial firm exhibited for the first time, and they also chose the 'Bog-Look.' We felt that there was no point in duplicating the stands, and so we concentrated on showing as many as possible of the c.p. in cultivation. These ranged from *Helianthophora* to *Aldrovanda*, displayed on a very striking black and white stand.

This year presented us with a new challenge. All through the year we had been hearing from speakers at the meetings, and from the members during general discussions, about plants that hover on the edge of conventional carnivory, and which bring us back to the question "What do you mean when you say a plant is carnivorous?" There have been a number of definitions put forward, some of them lengthy and complex, yet I haven't seen one that does more than fit some of the facts. We decided to ask the general public what they thought by presenting them with the problem at Chelsea Flower Show. We had moved beyond the visual display and were trying to make the stand into an active part of the debate. Our aim was to provide a visually appealing stand that also inspired comment on the subject. We were awarded the Flora Medal for our display, aptly described by one member as the booby prize, and this reflected the visual effect of the stand, which was interesting but not spectacular.

We were slightly hampered right from the outset by size of the stand that we were allocated, seventeen feet by seven. This was longer and thinner than we had wanted, but this turned out to be an advantage. A strip two feet wide all round the stand was raised to a height of two feet, and the central block was raised two feet above this. This central peak was used

to display the tallest species and hybrids that we could get hold of, from the genus *Sarracenia*. These were to attract the eye to the stand, and to give us the maximum height possible. At the lower level, the stand held the bare bones of our argument. Along one of the sides, we displayed 'Sticky Traps,' a combination of carnivorous and non-carnivorous plants that had all developed sticky parts, for one reason or another. The other long side repeated the idea, using plants that had developed pitcher structures. The short ends were rapidly filled with displays of the British carnivores, and with a large patch of venus fly traps, respectively. I'm sure that there are lots of small children who would have been genuinely delighted if this plant had actually bitten the ends off of their probing fingers!

The 'sticky' display started with the sticky buds of Horse Chestnut, which had been in my refrigerator for three months to keep them in their sticky state. (They opened in record time when brought out into the warm.) These, and some species of *Rhododendron*, use sticky buds to protect their soft tasty innards from insect attack during the winter, and although they undoubtedly catch plenty of insects, they are not carnivorous. The same is true for *Plumbago* which protects its flowers with a mass of sticky hairs on the calyx. The London Pride, *Saxifraga urbium*, and indeed nearly all of the Saxifrages, is a bit more open to question, with sticky hairs all the way up the flower scape. The next plant in the sequence was the Petunia. The whole plant is covered with sticky hairs, and some Italian research from early in this century says that this plant is definitely carnivorous! The same paper comes to the same conclusions about *Silene viscaria* (Catch-fly), which we had to force into flower specially for the show. I'm not so sure about that one myself. The shepherd's-purse, *Capsella bursa-pastoris* is a strange novelty, with sticky carnivorous seeds, (see C.P.N., vol. 7, p. 39). The last major question mark hung over the head of *Martynia lutea* (synonym *Ibicella lutea*, related to the Unicorn Plant), which is

covered in all its parts with sticky glandular hairs. While I'm on the subject, I should mention the sticky-haired species of potato and tomato, which we tried to get onto the exhibit, but were thwarted by the plants' natural dormancy—without its sticky leaves, one potato looks much the same as another. Carnivorous vegetables seems rather a back to front concept anyway. From *Martynia* we progressed to *Drosophyllum*, probably the simplest of the conventional sticky carnivores, and then on to *Drosera* and *Pinguicula*.

The pitcher traps started at an equally simple level with the common lupine, which does no more than catch a drop-let of water in the centre of its leaf. The teasel (*Dipsacus*) carries this a bit further. The bases of the leaves join to form great buckets in which water and debris collect, and which raise it to the rank of possibly carnivorous. Following this, we had a display of *Tillandsia* (Bromeliads), selected from those species that have hollow bulb-shaped bases in which ant colonies live. This is one of the most sophisticated carnivorous (?) symbioses that I know. Another bromeliad, *Neoregelia*, returned us to the 'watery grave' principle, the green rosette of leaves forming a water-catching pitcher, and the bright red inner leaves acting as an attraction. From this, we moved to *Sarracenia purpurea*, using a very similar principle, but in the slightly duller green and purple. The 'true' carnivores then continued with *Darlingtonia*, and *Nepenthes* (which looked distinctly ill by the end of the week) and then on to the most complex trap of all, represented by *Utricularia sandersonii*.

Throughout the week the stand was kept manned by at least four people, who were kept busy answering questions and holding lively debates both among themselves and with the public.

I'm sure a number of people wondered what we were doing, but couldn't be bothered to ask; however, these were outnumbered by the people who were prepared to tell us what they thought.

(Continued on page 106.)

I am a novice grower of *Nepenthes* that I grow along with my collection of other plants. My main interest lies mostly in orchids and bromeliads, so the specific needs of the *Nepenthes* have not exactly been met to the fullest extent. Nevertheless, they perform above my expectations, reacting to my semi-neglect.

As soon as I had developed an interest in this family of plants, I was faced with two problems. First, where to obtain my stock, and second, to locate adequate literature on the subject. Fortunately I was able to overcome the first hurdle by obtaining plants mostly from Asia and Japan. I have assembled a collection of *Nepenthes* consisting of nine species and 21 hybrids which I grow under lights and in a greenhouse. My cultural practices consist of the following: To propagate by seed, I cut up live sphagnum moss with scissors, wet with distilled water, squeeze out lightly and spread out in plastic bags. I then scatter seeds on surface and moisten them with distilled water from an atomizer. I keep them in low light and warm. As the young plants grow, additional misting at 2-to-3-day intervals is beneficial. When the plantlets are about ½ inch in size, I plant them in community pots, still covered with a plastic bag which remains until they reach about 1½ inch in diameter.

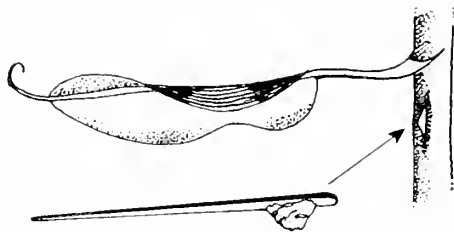
Feeding: I use mostly organic fertilizers such as manure in the proportion of about one pound of fresh cow manure mixed in three U.S. gallons of water. It is sieved through window screen and poured on the plants' mature leaves all during the summer growing season. Urine (Asia) was also used alternatively in a 40:1 ratio applied in the same manner. I feed every three to four weeks. In winter, a balanced complete fertilizer, (NPK as 20:20:20) with trace elements is used every six weeks.

What I have been describing to you

in the above is nothing out of the ordinary, but here comes information that might be of value to some growers of *Nepenthes*. In 1980, I worked with Dr. James Brasch of McMaster University of Hamilton, Ontario, on a plant hormone formulation primarily for orchids. I was the grower who mostly tested the product due to the large number of *Phalangiopsis* orchids I grew and having flower spikes numbering over 100 on my plants for experimentation. After trial and error, the hormone was finalized and the results were very gratifying by being able to produce 70 young plants (mericlones), in the first season of application. In the meantime, our interest turned to a wider field of plants on which to try the hormone formulation. It worked with variable success and at times failed completely. So I decided to experiment with *Nepenthes*, due to their difficult propagation. The hormone worked extremely well on *Philodendron*, etc., wherever a dormant eye is present. The eye (axillary bud) is quite pronounced in most cases in *Nepenthes* where I placed the hormone preparation. In about 80 to 90 percent average, the plants developed new side shoots at all points of application, grew well and pitched in the same manner as the mother plant. Root development in each case was completely absent. Basically, by using the hormone, *Nepenthes* will become a stockier plant with a good number of side branches and greater number of pitchers, which are desirable traits, Illustration 1, 82. If one wants to obtain a larger number of cuttings for propagation, now this is possible. Presently I have *N. gracilis* with eleven branches that I induced with the hormone. The hormone formulation is readily available since it is marketed and can be obtained from: KEIKI GROW Plant Hormone; P.O. Box 354, McMaster University; Hamilton, Ontario L8S 1G0; Canada. Prices

Why They Do *(from page 97.)*

As we continue to offer and acquire our knowledge among ourselves, certain patterns begin to develop among all the articles and experiences, and it is from these patterns that we can learn and ultimately successfully grow that CP. So, continue to write and read and grow by all means, but do so in perspective.



Approximately quantity of hormone to be used on toothpick as an applicator. Position of dormant bud on nodes occasionally is further down or even completely behind leaf axil.



Emerging young side shoot triggered by the application of hormone.



Examples of short and long leaf cuttings.



Emerging shoot at point of hormone application.

Photo by I. Kocsis.

are 15 cc @ \$15, 30 cc @ \$28, 45 cc @ \$35 postpaid anywhere. Further reading suggested on this subject telling in detail how the hormone works with plants, Bull. Amer. Orch. Soc., Oct. 1980 49 (10): 1123, "You can meristem with hormones" by J. D. Brasch and I. Kocsis.

By a very good fortune, I became an owner of some old English horticultural books. Cassels' *Popular Gardening* from about 1875-1885 (actual publishing date missing) and *Greenhouse and Stove Plants* by Thomas Baine, London, 1885. From these books I would like to quote some entries on *Nepenthes*, since as we know those were the days when Victorian gardeners and plant fanciers devoted themselves to the cultivation of *Nepenthes* in their greenhouses, conservatories and "stoves."

"Bornean species are plentiful and easily procurable (in 1885 by author). Those who grow them for sale, propagate them by the thousands. Most failures are due to placing the plants too far from the roof glass. They should be hung only a few inches from the roof and lowered as they get taller. Never injure any of the delicate roots. When repotting one should not attempt to free all roots from the old medium. The risk of damage is too high! When in vegetative growth it needs plenty of water on a daily basis, and even in winter should be kept wetter than most plants.

To reach full potential, *Nepenthes* should be three to five years old, and cut back about twice to possess four to six side shoots with many pitchers. Around the end of February, potting on and taking of cuttings can be done. Plants should be placed in relatively small pots to prevent the media from turning sour. Some shading is required during all times, slightly heavier in the hottest months of the summer. Pitchers formed in the dull fall and winter months will open with warmth and higher light levels of spring weather. Grow them with a minimum of 65° F. at night higher with summer. This is also a safe winter minimum temperature for them. Good drainage, and high humidity should be provided.

Cuttings of two joints with eyes and all portions of leaves of the upper joint retained. Insert in mix of crocks and sand, cover with glass and give bottom heat of 70 to 75 ° F. They will strike any time of the year if the correct conditions are provided for. When large plants are cut back, the base will throw one to several side shoots. Baskets or pots are equally good while pots will dry out slower. Pots can be hidden with sphagnum and placed in wire containers. Pinch cuttings in early spring to check leggy growth. Each cutting should have one to two eyes, with one eye being sufficient to produce a plant when longer cuttings are not possible. A cutting about a foot in length produces roots freely, Fig. 3.

A frame of coconut husk fiber kept very moist and heated to 75 to 80° F. can be used to insert cuttings. Roots will form in about six weeks time. In case the above is not available, a flat pan filled with water some 2½ inch pots may be used. The cuttings placed with their bases through the hole of the pots, but not allowed to touch the water. Over this place a "bell glass" (plastic bag in 1981) and keep in high "stove" temperature (80° F.) The cuttings soon callus and form roots at which time they may be potted up in pure sphagnum moss. For species such as *N. albo-marginata*, *N. rajah*, and *N. sanguinea*, it would be safest to partially sever the portion intended for cutting from the parent stem. Tie a bunch of moist sphagnum moss with sand around the incision. Keep continually saturated with moisture (air layering!) The above species of *Nepenthes* require more abundant water at all times than other species."

With the above I am not offering anything conclusive on *Nepenthes*, but perhaps some or all this will prove to be of some use for those who are interested in this very fascinating group of plants. The books I cite in this article are not available to most, and growers of those times achieved a wider acceptance and popularity of *Nepenthes* than was thought. At least they knew how to deal with them. Personally, I am ready to learn from anyone who has knowledge on this subject.

Review of Recent Literature

Angerillia, N.P.D. 1980. Influences of aquatic plants on colonization of artificial ponds by mosquitoes and their insect predators. *Can. Ent.* 112:793-796.

The plants involved were *Utricularia minor*, *Eloдея canadensis* and *Lemna minor*. There were fewer mosquito eggs and larvae in ponds filled with the above plants than in plantless controls, and more predators in the *Utricularia* and *Eloдея* ponds than in the *Lemna* and plantless ponds.

Bopp, M. and I. Weber. 1981. Hormonal regulation of the leaf blade movement of *Drosera capensis*. *Physiol. Plant.* 53:491-496.

A summary of this fascinating work appeared in the June, 1981 issue of CPN (10:37). DES

Bosserman, R.W., Elemental composition of aquatic plants from Okefenokee Swamp (Georgia and Florida, USA). *J. Freshwater Ecology* 1(3): 307-320 1981.

Three species of *Utricularia* (*purpurea*, *juncea* and *inflata*) were sampled from 7 marshes and partitioned into roots, rhizomes, stems, petioles, leaves and flowers. *Utricularia* had the highest concentrations in iron and aluminum and generally the elements, potassium, calcium, sodium and manganese were higher in concentration in upper plant parts than roots and rhizomes.

Carlquist, S. Wood anatomy of *Cephalotaceae*. *Int. Assoc. Wood Anat. Bull.* 2(4):175-178 1981.

The study of the wood anatomy of *Cephalotus* apparently shows that it is related to the *Saxifragaceae* and allied families.

Forsyth, A. 1982. Bog behavior: Pitcher plants and sundews. *Horticulture* 60:24-29.

An excellent article by a Canadian naturalist covering *Sarracenia purpurea* and

Drosera rotundifolia as they grow in northern bogs and written from an ecological behaviorist viewpoint, as the title suggests. The author stresses natural habitat, but gives advice on outdoor growing, to be recommended for these species over indoor growing. Accompanied by six superb color photos (one full page) and a range map. DES

Heusser, C., Palynology of cushion bogs of the Cordillera-Pelada, Province of Valdivia, Chile. *Quat. Res. (NY)* 17(1):71-92 1982.

Fossil pollen identified as *Drosera uniflora* was found in deposits that dated 10,425 carbon-14 years ago. This species continues to grow today in the Cordillera Pelada. The author discusses the climate changes that occurred during this long time period.

Hill, BS and GP Findlay. 1981. The power of movement in plants: the role of osmotic machines. *Quarterly Rev. Biophysics* 14:173-222.

Among several plant genera discussed, the CP genera of *Drosera*, *Dionaea*, *Al-drovanda* and *Utricularia* are of course reviewed. These are brief summaries in which the main thrust is the authors' contention that movement is chiefly due to osmotic fluid shifts stimulated through various mechanisms. The paper should be read for more details including mathematical formulae and bibliography. DES

Hindley, K. 1980. The association of lady-slipper orchids and insectivorous plants: Part III. The association of *Cypripedium reginae* and *Cypripedium pubescens* with *Drosera rotundifolia* in bogs in Vermont. *Orchid digest* 44:233-235.

In a 20-acre sphagnum bog in Vermont, the author found comparatively few, widely scattered clumps of the above orchids. The sundews were always found in association with the orchids, in spite

of apparently similar habitat abundant throughout the large area. DES

Hooper, R. R. 1982. Collecting beetles in an acid pitcher plant bog. *Blue Jay* 40:80-81.

The author spent several days in a Saskatchewan sphagnum bog collecting beetles. One interesting feature of the article is that the author found many records or unusual species by noting elytra and other chitinous body parts in *Sarracenia purpurea* pitchers, which thus served as natural concentration traps for the collecting entomologist. DES

Iijima, T. and T. Sibaoka. 1981. Action potential in the trap-lobes of *Aldrovanda vesiculosa*. *Plant and Cell Physiol.* 22:1595-1601.

Action potential studies indicate a mechanism very similar to *Dionaea*. This is interesting in view of differences in natural habitat adaptations. Both mechanisms may have advanced from the slow one of *Drosera*. DES

Iijima, T. and T. Sibaoka. 1982. Propagation of action potential over the traplobes of *Aldrovanda vesiculosa*. *Plant & Cell Physiol.* 23:679-688.

An action potential was generated in a cell in the base of a sensory hair. Recordings indicated that the potential spread electronically over the lobe. EM disclosed numerous communicating plasmodesmata between cells which would allow an electrical transmission between cells.

Moffat, A.S. 1982. The acid-rain problem. *Horticulture* 60:12-19.

There has been much discussion lately in popular and scientific annals about the acid rain problem, often with few facts to back up emotional assertions. The author does a fine job of summarizing what we know to date, including what little experimental work has been done. In fact, while acid rain may decrease various kinds of productivity

of some plants, it increases many others (including agricultural species). The ratio is about 50/50 overall. The greatest threat of acid rain then may be to diversity rather than plant life itself (effects on animal life are far more profound in many cases, especially amphibians and fishes). CP are not specifically mentioned, but it is noted that eutrophication in many Adirondacks boggy lakes is arrested. Specific research on CP would be of interest.

DES

Nordbring-Hertz, B. and G. Odham. 1980. Determination of volatile nematode exudates and their effects on a nematode-trapping fungus. *Microb. Ecol.* 6:241-251.

Volatile organics were determined by gas chromatograph, and CO₂, NH₃ and acetic and propionic acids by other methods, as expressed from nematodes. The effects of some of these compounds in trap induction in *Arthrobotrys oligospora*. Generally (somewhat concentration dependent—see paper), CO₂ inhibited, NH₃ stimulated and the two acids had no effect on trap induction.

Schnell, D.E. 1982. Effects of simultaneous draining and brush cutting on a *Sarracenia* L. population in a southeastern North Carolina pocosin. *Castanea* 47:248-260.

A large, privately-owned pocosin was drained and cleared for silviculture. This afforded an opportunity to observe the phenology and some possible relationships of pitcher plant survival under varying conditions after the treatment. Immediately after clearing, increased light and space resulted in a massive display of three *Sarracenia* spp. the following spring, and reasoning is offered against nutrient ash effect. As the results of ditching became effective a year or more later, pitcher plant growth ceased, indicating soil moisture as a limiting factor since there was insufficient pocosin shrub

regrowth yet to bring light and space limitations into play. The observations were in effect a model of the effects of these three factors on pitcher plant populations. (Reprints: D.E. Schnell, Rt. 1, Box 145C, Pulaski, VA 24301).

Simons, P., The touchy life of nervous plants. New Scientist, March, 1982.

This popular article discusses the need for plant scientists to resume research into the "real" electrical signals that a large variety of plants evoke including CP for regulating many different processes. The author describes why electrophysiology was neglected for decades, which left a gap of knowledge that was filled by sensationalists who grossly exaggerated the plants' response to stimuli. This is an article that will stimulate new ideas for research and should be read by everyone interested in this area.

Watson, A. P., et. al. 1982. Arthropod associates and macronutrient status of the red-ink sundew (*Drosera erythrorhiza* Lindl.). Australian J. Ecol.

Various arthropods associated with this sundew in native habitat were studied. Several were prey for the sundew, some were pre-robbars. Physical model studies in the field indicated that insect components were sufficient to supply 100% of nitrogen and phosphorous, but a negligible portion of potassium which came from soil sources.

Wolfe, L.M. 1981. Feeding behavior of a plant: Differential prey capture in old and new leaves of the pitcher plant (*Sarracenia purpurea*). Am. Midl. Nat. 106:352-359.

An environmental chamber of *S. purpurea* plants was set up in the lab and the plants captured measured numbers of fruit flies introduced into the chambers. New pitchers captured more insects than old, as did pitchers with wider openings. Also, older pitchers on plants with a new pitcher captured more flies than older pitchers on plants without new pitchers. These results were within limits of numbers of introduced flies which were varied.

DES

WANT ADS

Jim Comia (18701 San Rufino Dr., Irvine, CA 92715). WB: *Sarracenia oreophylla*, *S. rubra wherryi*, *S. rubra gulfensis*, *S. rubra alabamensis*, *S. rubra jonesii*, *S. rubra rubra*, *Pinguicula vulgaris*, *S. purpurea venosa* "Louis Burk" flower, *S. flava* "red-throat," *Pinguicula macroceras*.

Harris Emmons III (824 McGilvra Blvd. E., Seattle, WA 98112). WB: (plants) *Drosera adelae*, *D. filiformis*, *D. schizandra*, *D. regia*, *D. binata* (T form), *Pinguicula caudata*, *Cephalotus*.

Steve Friedrich (172 Hutchens Close, Baringa Gardens, Melba A.C.T. 2615, Australia). Wanted: Plants, seeds or cuttings of *Nepenthes* and *Heliamphora*. I have for trade *Drosera prolifera*, *D. schizandra*, *D. indica*, *Byblis gigantea*, *Chrysamphora californica*, *Nepenthes mixta*, *N. balfouriana*, *N. mirabilia* and many others.

Donald Kalb, Jr., (Box 25, Peosta, Iowa 52068). WB: *Byblis gigantea* seeds or plants; *Drosera regia* seeds or plants.

Lee's Botanical Gardens (P.O. Box 7026, Ocala FL 32672). TS: giant *psittacina*, red *flava*, *flava mixima*, *psittacina* × *alata*, *psittacina* × *purpurea*, *flava* × *rubra*, *rubra* × *purpurea*, *psittacina* × *leucophylla*, *leucophylla alba*, many more. WT: *Nepenthes* plants or cuttings.

CHELSEA (from page 100.)

If I may be allowed to quote from our rules, the Constitution of the Society, our primary aim is 'to further the knowledge of the public in the field of carnivorous plants.' I think that this stand furthered everybody's knowledge.

Naturally, no education process ever stops, and we would be pleased to hear other people's comments on plant carnivory so that we can work towards a definition of plant carnivory that is acceptable to everybody. The Carnivorous Plant Society can be contacted at 'Carn View,' Lanner Hill, Redruth, Cornwall TR16 6DA, ENGLAND. (John Sirkett's address.)

TITLE INDEX

Cultivating <i>Drosera linearis</i> (Goldie).....	19
Cultivating the orchid-flowered butterworts.....	46
Field studies on CP at UMBS.....	10
Field Trip to Singapore.....	74
Field Trip to Toolbrunup Peak.....	49
Introduction to <i>Genlisea</i>	13
Most dangerous (looking) <i>Nepenthes</i>	64
Notes on <i>Nepenthes</i>	101
Once in a lifetime.....	57, 89
Photographic primer of variants of <i>Sarracenia rubra</i> Walt.....	41
(from) <i>Sinnesorgane in Pflanzenreich</i> . Insectivores: <i>Dionaea muscipula</i>	9, 32
<i>Drosera</i> and <i>Drosophyllum</i>	66
The Chelsea flower show.....	99
The problem of carnivory in the common toothwort.....	17
Tissue culture of <i>Pinguicula</i>	93
Why they do or do not grow.....	96

GENERA INDEX (Photos are italicized)

<i>Aldrovanda</i>	50, 87, 99, 104
<i>Arthrobotrys</i>	25
<i>Cephalotus</i>	104
<i>Darlingtonia</i>	88, 100
<i>Dionaea</i>	5, 7, 9, 12, 21-23, 27, 32-40, 50, 56, 68, 80, 84, 86, 94, 104
<i>Drosera</i>	5, 6, 7, 10, 11, 19, 20, 25, 48-49, 50, 56, 66-73, 79, 86, 87, 88, 100, 104
<i>Drosophyllum</i>	66-73, 88, 100
<i>Genlisea</i>	13, 15, 16, 20
<i>Heliamphora</i>	87, 88, 99
<i>Lathraea</i>	17, 20
<i>Mimosa</i>	50
<i>Nepenthes</i>	1, 2, 5, 25, 27, 31, 50, 56, 57, 60, 61, 62, 63, 64, 65, 73, 74-78, 77, 81, 86, 88, 90, 91, 92, 100, 101, 102, 103, 108
<i>Pinguicula</i>	6, 7, 11, 13, 25, 46-47, 50, 51, 52, 56, 79, 93, 94-95, 96, 100
<i>Polypompholyx</i>	13
<i>Sarracenia</i>	5, 8, 10, 11, 13, 19, 25, 41, 42, 43, 44, 50, 53, 54, 55, 56, 79, 84, 87, 88, 97, 100, 104
<i>Silene</i>	31
<i>Sytlosanthes</i>	50
<i>Utricularia</i>	5, 10, 13, 18, 19, 28, 50, 56, 79, 88, 100, 104

AUTHOR AND PHOTOGRAPHER INDEX

Abel, H., 4	Netherby, B., 31
Barnett, W., 4	Pereira, 5
Bednar, B., 5, 55	Powell, J., 56
Carow, T., 5, 6-7, 27	Rea, T., 31
Carroll, B., 84, 93-95	Russell, G., 56
Clancy, S., 89	Schnell, D., 3, 41-45, 83, 87, 96
DeLoach, M., 5	Shailer, K., 8
Depaz, M., 18	Simons, P., 87
Claudi-Magnussen, G., 13	Sirkett, J., 99
Dodd, C., 64, 65*	Sivertsen, R., 87
Gagliardo, R., 88	Sizemore, S., 94-95
Bigson, T., 84	Smith, S., 46, 47, 51, 65, 87
Haberlandt, G., 9, 32, 66	Spiers, D., 31
Harbster, D., 86	Steiger, J., 29, 52
Kocsis, I., 101-103	Studnicka, M., 17
Korolas, J., 19	Taylor, D., 57, 61, 81, 89-92
Lowrie, A., 31, 48, 49	Walter, A., 78
Mauder, R., 86	Williams, S., 36
Mazrimas, J., 1, 86, 91	Woodring, M., 77
Mellichamp, L., 8, 10, 11, 28, 45	Zillins, R. V., 108

*Photo attributed to R. V. Zillins (CPN, September, 1982, page 65) was actually taken by Cliff Dodd II.



Nepenthes bicalcarata growing in cultivation.

Photo by R. V. Zillins